USNO Report

U.S. Naval Observatory
Washington, DC and Colorado Springs, CO

Demetrios Matsakis

CGSIC Timing Subcommittee
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Overview

- USNO Master Clock
- GPS Timing Operations
  - Precise Positioning Service (PPS)
  - Standard Positioning Service (SPS)
- Network Time Servers
- Internet and Other Time Products
- Precise Time and Time Interval (PTTI)

USNO Master Clock

Time Service Department

- Ensemble of
  - 73 Cesium standards
  - 22 Hydrogen masers
- Real-time realization of UTC(USNO)
- Clocks incorporated into International Atomic Time (TAI)

USNO GPS Operations

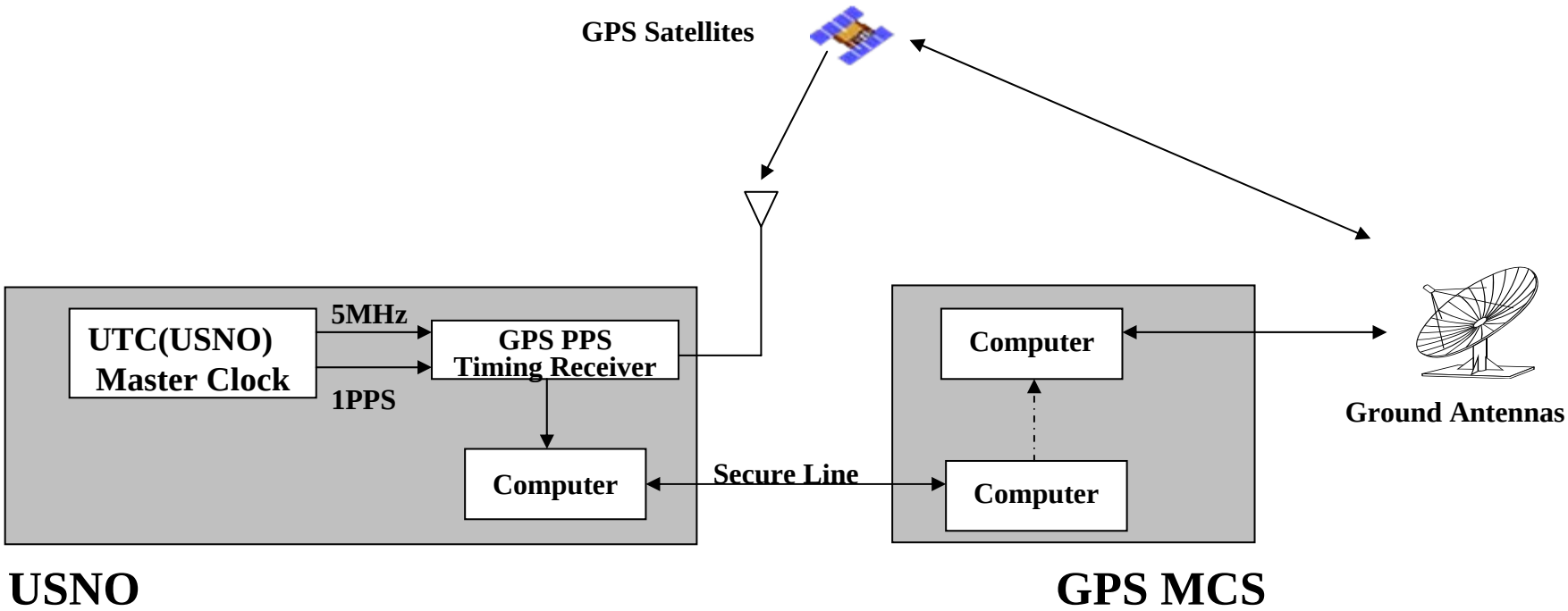
Time Service Department

- GPS Time Monitoring
  - Provide GPS MCS with a reliable and stable reference to UTC(USNO)
    - GPS Time Synchronization to UTC(USNO)
    - GPS Time corrections provided daily to GPS MCS
- Developing close cooperation with other GNSS systems
  - Covered in next presentation
  - Technical issues are solvable

USNO GPS Operations

Time Service Department

- **GPS Time Monitoring**



USNO GPS Operations

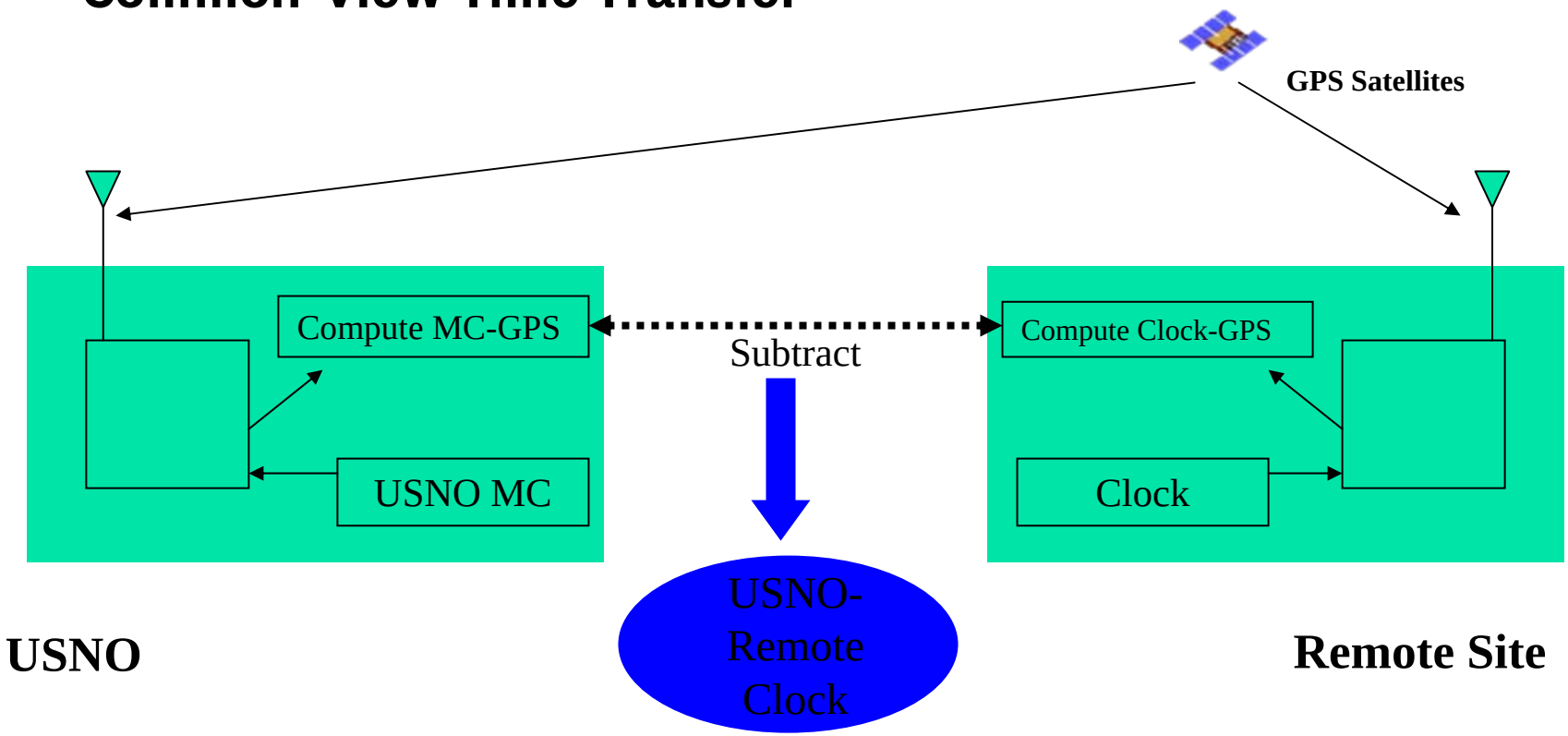
Time Service Department

- Common-View (CV) Time Transfer
  - Used as a backup to Two-Way Satellite Time Transfer (TWSTT) to:
    - Incorporate USNO clocks into TAI
    - Steer Remote Clocks to UTC(USNO)
  - Participate in worldwide relative GPS calibrations conducted by the BIPM

USNO GPS Operations

Time Service Department

- **Common-View Time Transfer**



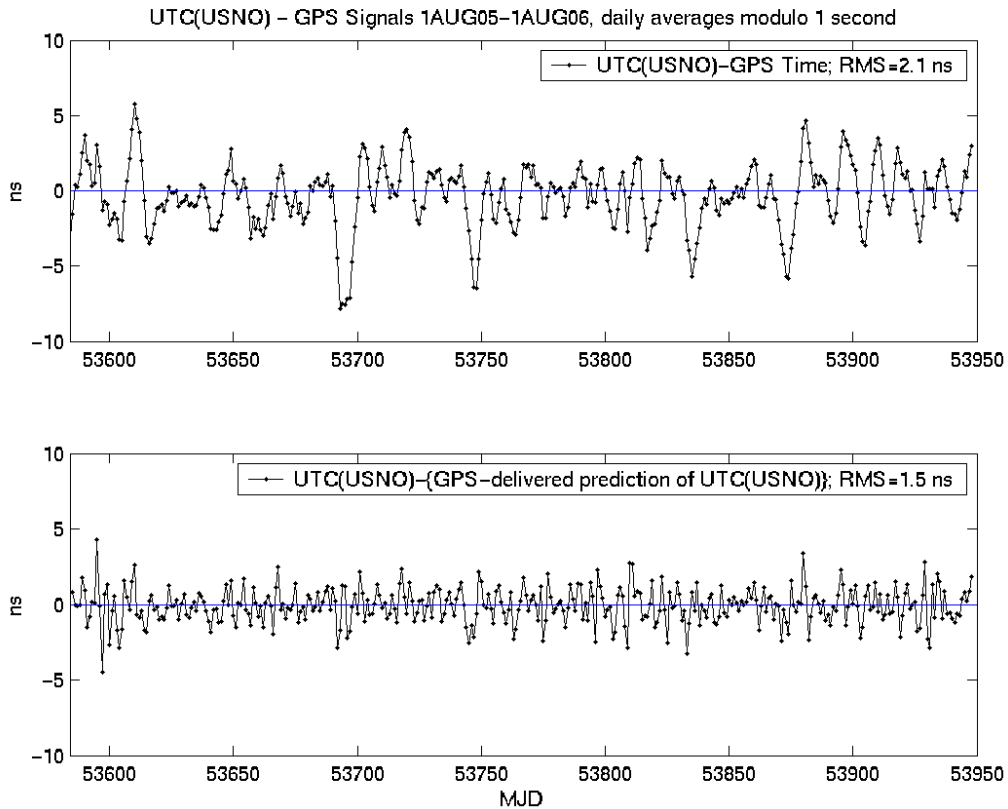
Precise Positioning Service (PPS)
USNO Receivers

- AOA TTR-12 SM
  - 12-channel based on GPS MSRE
  - Dual-frequency
  - All-in-view Tracking
  - Temperature stabilized antenna electronics & cables
- Primary purposes
  - GPS Time Monitoring for GPS MCS
  - CV Time Transfer between DC & CO
- SAASM receivers
  - Received, and accepted
  - Under calibration

Standard Positioning Service (SPS)
USNO Receivers

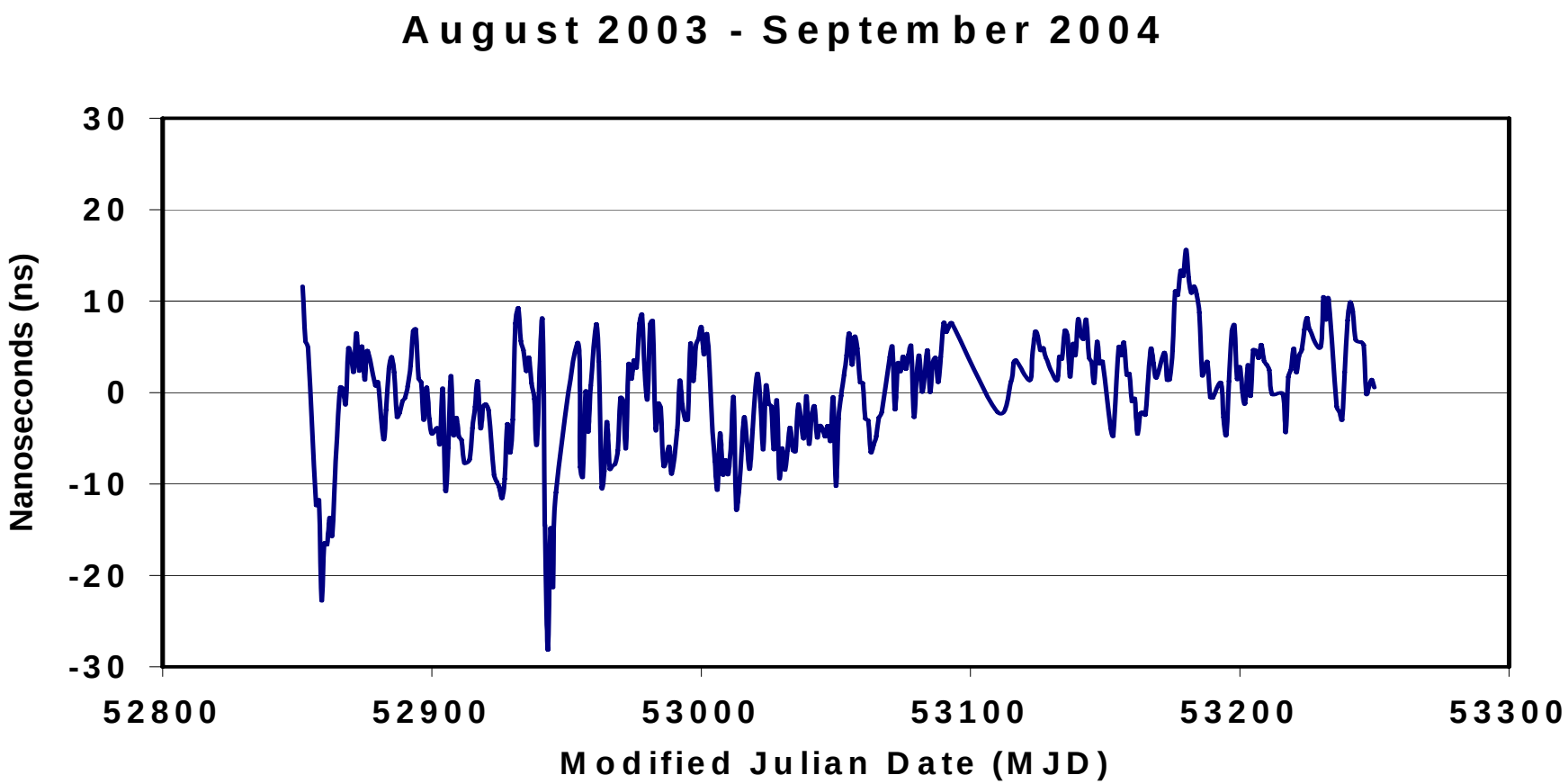
- Current Operations
  - Motorola Oncore-based receiver system (TTS-2)
    - 8-channel, single frequency
  - 3S Navigation GPS/GLONASS
- Carrier-Phase GNSS Receivers
  - 3 Ashtech Z-12T
    - JPL Real Time Global Differential System
  - NovAtel GPS/WAAS/EGNOS
    - Monitor UTC(USNO)-WNT
  - Javad, Septentrio, and upgraded NovAtel on order
  - Still other manufacturers/models in the works

GPS Time Monitoring



WAAS Network Time (WNT) Monitoring

UTC(USNO) –WNT, offset removed



USNO Network Time Servers

Time Service Department

- **Internet http://tycho.usno.navy.mil/ntp.html**
  - 26 U.S. Stratum-1 Time Servers
  - USNO Master Clock & GPS SPS Time References
  - Millisecond Time Synchronization
  - 200 Billion Network Requests yearly
- **SIPRnet**
  - 2 U.S. Stratum-1 Time Servers operational
  - 2 OCONUS awaiting deployment
  - USNO Master Clock References
- **Contact: Richard E. Schmidt, 202-762-1578 DSN 762-1578, res@usno.navy.mil**

Internet and Other Time Products

Time Service Department

- **ftp server, ftp://tycho.usno.navy.mil**
  - 9 million connections/month
- **Time Service Web server, http://tycho.usno.navy.mil**
  - 1.6 million connections/day
  - 2.9 Gigabytes transferred/day
  - Audio Service installed
- **Telephone Voice Announcer**
  - USNO DC, **202-762-1401 (DSN 762)**
  - USNO AMC, **719-567-6742 (DSN 560)**
- **Modem Time**
  - USNO DC, **202-762-1594 (DSN 762); 1200 baud 8N1**
  - USNO AMC, **719-567-6743 (DSN 560); 1200 baud 8N1**

Improvements in the works

- **Two Way Satellite Time Transfer (TWSTT)**
  - **Radome**
    - Provides thermal stability
  - **Satellite Simulators**
    - Delivered, to be tested
    - Continuous calibration monitor
- **GPS simulator development**

Complete Infrastructure Redesign

DISCLAIMER

- Manufacturers and products are identified only for technical clarity
- Use by USNO does not imply an endorsement
- Past record at USNO may not be a reliable predictor of future performance.